



## **REVIEW OF A SELECTION OF RURAL SAFETY AUDITS**

**Review and Audit Division  
Report No. 95/415S**

## REVIEW OF A SELECTION OF RURAL SAFETY AUDITS


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## DISCLAIMER

This is a final report. A draft has been reviewed by a peer group. It has been modified to take account of the comments of that group.

This report contains the findings, opinions and recommendations of the reviewer based on an examination of a sample of audit reports only. As a consequence the review may not identify all features of all audit reports.

This report has been prepared for the purpose of assisting Transfund New Zealand to discharge its statutory responsibilities in terms of the Transit New Zealand Act 1989 and to provide advice to the authorities concerned. The Transfund Board is not bound by any of the contents of this report.

Notwithstanding that this report may contain statements in relation to technical matters, both of a general nature and in relation to specific issues, in no way should readers of the report rely solely on its contents. Readers must seek appropriate expert advice on their own particular circumstances and rely on such advice.

*Note: This review was commenced prior to the establishment of Transfund New Zealand consequent upon the Transit New Zealand Amendment Act 1995, which came into effect on 1 July 1996.*



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## A REVIEW OF RURAL SAFETY AUDITS

Project No 5C8699 00

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# A REVIEW OF RURAL SAFETY AUDITS

## 1 INTRODUCTION

At the request of Dr Ian Appleton the Manager Safety Auditing, Transit New Zealand, a review has been undertaken of some 30, rural road safety reports, completed in the period up to the end of June 1994

The purpose of the review is to provide feedback to the "industry" on issues arising from the road safety audit process

In undertaking the review a number of data summarises have been produced However due to the range of.

- i project types,
- ii audit stages,
- iii consultant teams,
- iv audit teams,

it has not been possible to produce definitive statistics The review therefore comprises a series of observations rather than statistical analysis of the situation

The Review has considered safety audits of rural roading projects ranging from shape corrections, without improvements, through to significant realignments Table 1 summarises the number of audits reviewed at each stage

**Table 1** Summary of Audits Reviewed

Audit Stage	Description	Number
Stage 1	Feasibility	1
Stage 2	Project Assessment	4
Stage 3	Final Design	20
Stage 4	Pre Opening	5

It can be seen that the sample is somewhat biased towards Stage 3 Design Audits

Readers requiring more detailed information should contact Fergus Tate of Works Consultancy Services Phone (04) 4717012, Fax (04) 4711397

It should be noted that the observations made are those of the reviewer and not Transit New Zealand or Works Consultancy Services Limited

Furthermore it is not the intention of the review to identify and/or criticise the work of any auditors or audit reports, however some comments may be recognisable

Given that the audits reviewed occurred at a time when Road Safety Auditing was in its infancy, and a variety of approaches were being trialled, these examples provide a useful basis for discussion on the future development of audit techniques

In preparing these notes the reviewer has considered

- staffing of Audit Teams
- mechanics of the audit process
- the audit reports
- common problems

Finally there are some general observations on whether or not Road Safety Auditing is "working" in practice

A summary has been provided, written with the intention that it may be detached and used as a stand alone "flier" to those in the industry who do not have the time to read the longer version

## 2 AUDIT TEAMS

### 2.1 Size

The sample typically included Audit Teams comprising two persons. However a number of Pilot Audits were also included. Pilot teams were established as part of the introductory process and included a wide range of participants with a variety of skills and expertise with up to 5 participants. The Pilot teams appear to have identified more, and possibly a wider range of problems, than smaller audit teams.

The sample also included an audit undertaken using a team of one. It is interesting to note that despite an introductory statement, that "the nature of the project was such that it could be audited by a single person", the Client response identifies a number of points which appear to have been missed by both the Auditor and the Consultant.

While there will always be items that may be missed in an audit the observation must be

- 1 the larger and more diverse the team the less likely items will be missed,

- 11 audit teams of only one person should not be contemplated since these,
- do not allow ideas to be "bounced around",
  - may lead to the auditors concentrating on some aspects at the detriment of others

## 2.2 Auditor Availability

An early concern, related to the establishment of auditing in New Zealand, was that the "stock" of auditors was limited. It is pleasing to note that 52 New Zealand based auditors (and observers) participated in the sample audits.

Rather disappointingly only 6 persons accompanied audit teams as "observers", receiving training. Of these 6 only 2 were observers on audits other than Pilot Teams established through Transit New Zealand.

It is also of interest to note that of the 52 persons involved in auditing only 8 had undertaken 5 or more audits. While the increase in auditor "stock" is important, it is suggested that rather than seeking further increases in the "stock", attention should be focused on increasing the experience of those who have been involved in only one or two audits.

## 2.3 Composition

The composition of the Audit Teams is seen as important. It appears from reading the reports that particular auditors tend to identify similar problems in each audit. While this may reflect common problems it may also result from the auditors having interests or expertise in a particular area such as drainage, signage or pavement. It may also mean that other areas in which a particular auditor may not be as confident is not as well reported.

Clients need to be aware of Auditors strengths and select or blend Auditors according to the projects that require auditing.

It is also clear that some particular groupings of Auditors have appeared in the sample. This may well be because of the sample size and the fact that Audit Teams may have been formed to undertake a series of audits at a particular time.

There would appear to be a need to mix Auditors so as to continue cross fertilization of ideas and to develop a broad base of skills.

This to a certain extent needs to be Client driven, although Auditors on the other hand may well help themselves by holding master checklists which may be annotated with those additional items which they may learn from others.

### 3 MECHANICS OF AUDITING

#### 3.1 Audit Stages

Four audit stages are identified in the Transit New Zealand Policy and Procedures. An observation is made that the earlier the audit stage ie working back from the Stage 4 Pre Opening audits, the less likely the project details will fit the assumed audit structure.

While Pre Opening audits are readily located in the project process, Stage 3 Final Design Audits are sometimes undertaken with less than final design drawings or documents. It is important in this case for Auditors to note what documents are not available at the time of Audit.

The biggest differences between project and audit stages are appearing at the Stage 2 Project Assessment Stage. The projects in this category appear to be spread between

- Stage 2½, that is the project data lies somewhat between Final Design and Scheme Assessment with a preferred scheme having been selected and a considerable amount of design has been undertaken, probable as a means of determining construction costs.
- Stage 1½ where the project data lies between the Feasibility and Scheme Assessment stage. Although a Stage 2 audit has been commissioned the audit reports have identified a large number of issues associated with the earlier audit stage (Stage 1 Feasibility) and question issues such as intersection control type and route choice.

It would appear that the Scheme Assessment (Project Assessment) Audit checklists are possibly more detailed than the project data available at the time of Audit and therefore combining Stage 1 and Stage 2 may be considered a worthwhile modification to the sequence. Alternatively some revision to the checklists may be required.

Only one Stage 1 audit was considered in the sample and in only a few cases were audits undertaken to review schemes where more than a single route or option has been detailed. This may however be a function of the single sample used.

#### 3.2 Night Visits

Night visits were undertaken for all Stage 4 Post Construction Audits but only 14 of the 22 Stage 2 (Scheme Assessment) and Stage 3 Design Audits were visited at night. For a further 3 it is not clear whether or not they were subject to a night inspection.



From the "problems" identified in those reports, where a night visit was undertaken, it is not obvious whether any additional problems were identified solely as a result of the night visit. It is however the reviewer's belief and experience that night visits are worthwhile and have on some occasions identified potential problems with delineation

### 3.3 Checklists

It is obvious that extensive use is made of the checklists. The checklists provided in the TNZ Policy and Procedures were an initial "draft" and have proved very successful. There are however some areas within the checklists that could be reviewed now that they have been in use for some time.

The classification of audit problems, undertaken as part of this review, has identified some duplication. In particular lists 2 (Local Alignment), and 5 (Signs and Lighting) may well be combined with 1 (General Topics).

There is also a personal preference to reorder some items to better fit project development so that *speed environment* and *design speed, junction location and type* appear earlier than *signs and markings*.

Given the range of skills required for an audit, it is desirable to increase the detail within the checklist column "issues to be considered" to aid Auditors in areas where they are not "experts".

Appendix A includes some items that were noted on the reviewer's checklist either as a result of undertaking the review or from auditing in practice.

### 3.4 Design Documentation

It has been noted that at the various stages, material for some of the checklist items is not supplied or available at the time of audit. The Auditors task would be simplified if Designers were to prepare specific design statements that could follow the audit checklists. This would save the Auditors having to wade through documents to find out basic design details.

For example a design statement include statements of design speed and speed environment assumptions and how these have been determined, for markings and delineation a statement of the standard and any departures, any material not yet available could also be noted.

## 4 AUDIT REPORTS

### 4.1 Introduction

The style and format of the audit reports differs greatly. Two introductory styles have been identified:

- i "Mike Goodge" style with limited introductory statement,
- ii "Philip Jordan" style which has an expanded introduction outlining the aims or objectives of road safety audit

The Philip Jordan style introduces and outlines the objectives of the audit process. Although "wordy" there would appear to be two advantages of retaining this form of outlining the objectives:

- i to inform readers other than those within the industry, (such as councillors) just what is being reviewed, and why
- ii reminding those undertaking the audit of the objectives which are safety audit not quality audit. This point is discussed in more detail elsewhere.

There would also seem to be an advantage in specifying a standard form for the introduction. This would rapidly identify the stage, dates; site visit dates and conditions, client and consultants, without the need to read through the introduction. A draft of such a page is attached in Appendix B.

Outlining the method of problem ranking where applicable or the definition of a PROBLEM should also be undertaken in the introduction.

### 4.2 Audit Remarks

Again two approaches are apparent,

- i separate items in which each Problem is identified (numbered) individually, as are the recommendations
- ii "Discussion" style where paragraphs cover topics and may include more than one "problem" and a series of recommendations

Certainly from the point of view of this review, but also from a Consultant and Client response point the latter poses problems. The advantage of identifying each issue separately is that in responding, Consultants and Clients may refer to specific item numbers rather than being required to clarify which of a series of "problems" are being discussed.

*Wherever possible Problems and Recommendations should be numbered separately.*

A number of audit reports, particularly those in which some serious concerns are raised, have preambled the "Problem" identification with an outline comment that allows detailed explanation of an overall concern. Specific problems are then identified with reference to the common discussion avoiding the need to repeat the concerns for each problem or abridging the discussion of the problem.

This approach is favoured as it provides a clear picture to the reader.

The location of problems from the written description can be difficult particularly in Post Construction audits on larger projects. The liberal use of photographs and referencing to station values will assist the reader.

### 4.3 Structure of the Audit Problems

The approaches appear to be either, consecutive numbering based upon a "random" order of problems possibly related to the order of field observations, ordering problems in line with the checklists, with or without numbering identical to the checklists.

The latter approach appears cumbersome but does provide the Auditor and Client with the opportunity to identify those areas where problems have not been identified or where sufficient details have not been provided to the Audit Team.

The latter is a significant point particularly in Stage 2 and 3 Audits where not all of the details necessary to complete the checklists are supplied.

*Auditors must note what issues have not been audited*

### 4.4 Discussing Audit "Problems"

Given the aims and objectives of auditing each problem must have a recognisable safety impact.

*Particularly in the case of Post Construction Audits there remains a tendency to undertake a quality rather than safety audit.*

Auditors must when identifying a problem, discuss the mechanism by which the "problem" would either increase the occurrence or severity of accidents

In practice such discussions can be seen a test of the arguments about the safety impacts. The identified problem, may then be sustained and a measure of problem importance form the basis of a ranking

#### 4.5 Ranking

From the sample it would appear the use of "ranking of problems" is not wide spread. It should be noted that the Reviewer personally favours at least a 3 point ranking of problems

SERIOUS PROBLEMS	(***PROBLEM***)
PROBLEMS	(Problems)
COMMENTS	

This allows differentiation between issues. It is common, particularly in the earlier audit stages, for issues to be identified for consideration. These are not so much "problems" as matters the Auditors may consider worthy of investigation before decisions are made in design. The use of COMMENTS maybe more appropriate than the referring to these as PROBLEMS

Furthermore some items are identified as PROBLEMS when the problem is more that the issue has not been adequately documented in the material provided. A common example is that of construction management where the Auditors recommendations are often stating the obvious, as in Item 1 of the following example. In response Consultants will note that such actions would be common place

**Example:**

##### 1 CONSTRUCTION MANAGEMENT

Construction of the realignment will require emergency vehicles and the travelling public to negotiate their way through the works

##### **Recommendations:**

- (i) Emergency services should be given notice of the impending works so they can consider alternative routes.
- (ii) Provide public notification of probable traffic delays.

- (iii) Ensure that safe night-time passage is provided through the works for all vehicles.

## 2 DESIGN APPROACH

### Vertical Alignment

While the proposed design is adequate and resolves the problems stated in the scheme assessment, there appears to be an inconsistency in the standard of tie-in at the southern end where a lower 'K' value has been adopted

#### **Recommendation:**

**Review the design of the profile at the southern end to achieve a standard equal to the preceding works.**

Although in the above example the specific term PROBLEM has not been used, it is implied that items 1 and 2 carry the same emphasis and may "down play" the importance of item 2

It is considered that a new item be incorporated in the audit following problem identification, to identify items not included in the audit This together with the use of a ranking system would assist to differentiate issues

## 4.6 **Audit Team Statements**

It is noted that some Audits do not include the signed audit as per the example of the Transit New Zealand Safety Audit Policy and Procedures Given the importance of this work a signed statement is considered desirable and should have the signatures of the Team involved in the Audit including observers

## 4.7 **Appendices**

Together with the standard appendices containing documents viewed and photographs some Auditors include copies of the field checklists on which items that are not applicable, or for which material has not been provided, are noted There is merit in noting these issues however whether or not the checklist is the most appropriate place should be discussed

A number of reports include A3 copies of the drawings audited. Provided the dates and revision numbers of the drawings are listed under the "Documents Examined" there appears little benefit to be gained from including them in this Report, except to allow the reader to hold most of the material in one document. The drawings might be useful if the auditors have located problems by station or curve numbers or on the drawings themselves.

Where drawings have been appended they do not appear to be widely referenced in the text.

### 5 AUDIT RESPONSES

The notable failure in the process to date appears to be in the area of responses to Auditors from Consultants and Clients.

For the sample audits only 11 had attached the Consultants comments and 9 the Client decisions.

The responses of the Consultants appear to be varied. This would appear to be an area where some training may be required and perhaps an example included within the Policy and Procedures.

### 6 COMMON AUDIT PROBLEMS

One of the aims of the review is to identify those areas most regularly commented on by Auditors. In order to do this each audit comment has been reclassified in terms of the checklists and the occurrences tallied.

While identifying the most regularly occurring problems, this system does however have the potential to distort the results. For example some projects may involve no intersections while others may have a number. Buildability may be covered in a single statement, where as each access may have a separate statement for a common problem. The results do therefore reflect the nature of the projects to some extent. The summary of Table 2 is based upon the checklist numbering system and provides examples of the more commonly occurring problems.

Table 2 More Commonly Occurring Items

Stage 1 Feasibility		
Audit Checklist	Item	Common Problems
F1 General	1 7 Route choice or option choice	- Typically auditors question whether the best route has been chosen This occurs where a lesser route is preferred on economic grounds or where geometric improvements may have been desirable but not achievable on economic grounds
F2 Intersections	2 1 Number and Type of Intersections	- What is the potential to rationalise intersections  Auditors typically question the type of intersection control (roundabout, priority, signalised) and the potential to rationalise the number of intersections

Stage 2 Project Assessment		
Audit Checklist	Item	Common Problems
P1 General	1 6 Access to properties	- Inadequate sight distance at access points
	1 12 Batter Stability	- The need to consider the likelihood of usage by Heavy Commercial Vehicles and/or agricultural vehicles which may be slow moving and requires additional sight distance
	1 14 Typical Cross section	- Will batters be stable and what is the potential for batter debris to obstruct the carriageway
		- Many side slopes are steeper than the 1 in 5 and the shoulders narrower This may be more the result of a change in the TNZ guidelines over the period for which the audits took place
P2 Local Alignment	2 2 New/Existing Interface	- The location of the interface often results in changes in available friction and cross section within or close to circular curves

Stage 2 Project Assessment		
Audit Checklist	Item	Common Problems
P3 Intersections	3 2 Intersection Layout	<ul style="list-style-type: none"> <li>- The abrupt change in design standard at the interface may result in increased speeds in adjacent sections</li> <li>- Sharp reductions in pavement width are a common problem with the edgeline on the new section ending abruptly running into the shoulder of the old section</li> <li>- Auditors have questioned the type of control in particular the use of roundabouts in high pedestrian and cycle areas</li> <li>- The use of GIVEWAY or STOP control depending upon sight distances</li> <li>- The provision of adequate sight distance, Entry Sight Distance, rather than Safe Intersection Sight Distance has also been noted</li> <li>- Are the intersection layouts, control type, markings, signage consistent with the surrounding intersections</li> </ul>
	3 3 Readability	<ul style="list-style-type: none"> <li>- Is the path that vehicles need to take clear, are lane arrows likely to be obscured, are the lanes on the "other side" of the intersection in line with the approach lanes</li> <li>- Is the existence of the intersection clearly identifiable or are sight rails needed Particularly for remote intersections located on curves</li> </ul>
Signs and Lighting	5 3 Markers and Edge delineation	<ul style="list-style-type: none"> <li>- Generally the Auditors note that details of markings and delineation are not provided and that a high standard of delineation and markings will be required</li> </ul>



Stage 2 Project Assessment		
Audit Checklist	Item	Common Problems
P6 Objects	6 Physical Objects	<ul style="list-style-type: none"> <li>- Presently not included in the Stage 2 checklist the inclusion of this item is recommended Auditors often comment upon the need for guardrails and this should be considered early in the design process as it may have cost implications</li> </ul>

Stage 3 Final Design		
Audit Checklist	Item	Common Problems
D1 General	1 2 Drainage	<ul style="list-style-type: none"> <li>- Adequacy of culvert pipes is questioned</li> <li>- Existing problems with blocking of drainage that have not been addressed in the design are noted</li> <li>- Potential problems with blocking of sumps and channels that may result in water laying on the carriageway without being able to drain away eg behind a kerb</li> </ul>
	1 6 Access to Properties	<ul style="list-style-type: none"> <li>- Inadequate sight distance for vehicles using accesses often due to adjacent cut batters or obstructions such as signs, poles, vegetation</li> <li>- Where heavy commercial vehicles such as milk tankers or agricultural machinery will use an access regularly, additional allowances to the sight distance should be made, and also for turning paths</li> </ul>
	1 7 Shoulders and Edge Treatments	<ul style="list-style-type: none"> <li>- Side slopes steeper than 1 5 have been regularly commented upon Although this may result from the change in TNZ guidelines between Design and Construction</li> </ul>
D2 Intersections	3 1 Visibility	<ul style="list-style-type: none"> <li>- The night time visibility of side roads and the possibility of "hunting for" side roads or overshooting</li> </ul>

Stage 3 Final Design		
Audit Checklist	Item	Common Problems
	3 2 Layout	<ul style="list-style-type: none"> <li>- Obscured visibility lines due to batter, vegetation, signs etc is common</li> <li>- The need to check visibility for STOP or GIVEWAY control warrants</li> <li>- The positioning of signs and limit lines that guide drivers to stop in positions where they must "crane their necks" to see the approaching traffic</li> </ul>
	3 3 Readability	
		<ul style="list-style-type: none"> <li>- The need to provide sight lines to zero object height so that drivers have adequate time to read the intersection markings and position themselves</li> <li>- Identification of the intersections with sight boards and chevrons to guide drivers through the junctions</li> </ul>

Stage 4 Pre Opening		
Audit Checklist	Item	Common Problems
O1 General	1 2 Drainage	<ul style="list-style-type: none"> <li>- Drainage features may pose a hazard to errant vehicles eg               <ul style="list-style-type: none"> <li>- headwall design and location</li> <li>- poorly shaped deep side drains that will trap a vehicle</li> </ul> </li> <li>- Poor detailing of construction that will result in scour</li> <li>- General adequacy of facilities to cope with water without flooding the carriageway</li> </ul>
	1 21 Surface	
		<ul style="list-style-type: none"> <li>- Areas of bleeding or flushing particularly on tight bends that will alter the available friction midway through a curve</li> </ul>

Stage 4 Pre Opening		
Audit Checklist	Item	Common Problems
O5 Signs and Lighting	1 22 Contrast with Markings	<ul style="list-style-type: none"> <li>- Pavement failures that will result in potholes developing that vehicles may swerve around Subsequent repairs may provide uneven surface and friction in high demand areas</li> <li>- Debris, usually loose sealing chips, covering markings, often edgeline markings on curves</li> <li>- First coat markings wearing particular quickly with a resulting loss of contrast</li> <li>- Markings that have been sprayed onto loose material that should have been swept away</li> <li>- Migration of material from accesses and side roads onto markings</li> </ul>
	5 2 Signs Visibility and Position	<ul style="list-style-type: none"> <li>- Missing signs either existing signs that have gone missing during construction or signs that have been detailed but not erected or signs not detailed</li> <li>- Poorly positioned signs that are at too great an angle to the traffic or too far from the carriageway or erected too low, and road name plates in obscured locations</li> <li>- Signs that block sight lines particularly at intersections</li> <li>- Signs that are or will be blocked by vegetation</li> </ul>

### Comments

- Drainage issues are regularly commented upon However the impact of these upon safety may not be major since although wet pavements are a feature of Traffic Crash Reports, accidents associated with flooding are not as common as other types
- The most regularly identified problems in Stage 4 Audits are

- Drainage
- Surface treatment
- Markings
- Signs

Details of each of these, and most regularly the latter two, are often not available when the design audits (Stage 3) are undertaken. Furthermore, responsibility for these items often lies with construction or site supervision staff. It would appear desirable to include such people on audit teams to give a greater understanding of the safety impacts of the work.

- Although access details feature highly, this may have resulted from bias as the result of including an audit where numerous access problems were identified.

## 7 THE SUCCESS OF AUDITING

The period from which audits have been selected was early in the development of the audit process and as a result only one project had undergone audits at Stage 3 and 4.

As a consequence, a number of audits reports have raised issues that may well have been dealt with at an earlier stage had an audit been completed. That this has occurred is seen as a measure of the need for auditing, that this trend should decrease will be a measure of the success of the audit process.

The Client responses show a reasonably high degree of acceptance of audit recommendations.

One notable claim to success has been found in the Consultant and Client comments to the SH 6/94 Lumsden Intersection Stage 3 audit report where it is noted that the strong statements made in the Audit report had influenced the decision to relocate a war memorial.

Another example, but not from the sample, was the reconstruction of an intersection following receipt of an audit report.

## SUMMARY

A review of some 30 Road Safety Audit Reports, of rural roading completed to June 1994, has been undertaken and the following observations made

### Auditors

- 52 New Zealand based persons have been involved in Audits
- A select few have undertaken more than 5 audits
- The client in choosing audit teams should concentrate on providing more selected experience to those already exposed rather than introducing new stock
- Audit Teams of one should not be considered

### Audit Process

- Some rationalisation or restructuring of the Stage 1 and Stage 2 audits seems desirable
- Night visits are not always undertaken for Stage 2 and 3 audits
- Checklists are heavily used and some review of these should be undertaken now that the process is underway
- Designers could assist auditors through the preparation of design statements based upon the audit checklists ie Producer Statement

### Audit Reports

- A common introduction sheet to audit reports is suggested
- Audit problems should be
  - numbered (individually)
  - ranked by seriousness
- Referencing the location of PROBLEMS is cumbersome in some cases
- Audit responses (feedback) do not appear commonly used
- Examples of responses format should be included in the Procedures
- It is essential for audits to note what has not been commented on

### List of Items Regularly Commented on

#### Stage 1

General	1 7	Route choice or option choice
Intersection	2 1	Number and Type of Intersection

#### Stage 2

General	1 6	Access to property
	1 12	Batter Stability
	1 14	Typical Cross-section
Objects	6	Physical Objects (currently not included)
Local Alignment	2 2	New/Existing Interface
Intersections	3 2	Intersection Layout
	3 3	Readability
Signs & Lighting	5 3	Markers, edge delineation

#### Stage 3

General	1 2	Drainage
	1 6	Access to Properties
	1 7	Shoulders and Edge treatment
Intersections	3 1	Visibility
	3 2	Layout
	3 3	Readability

#### Stage 4

General	1 2	Drainage
	1 21	Surface Treatment
	1 22	Contrast with Markings
	5 2	Signs visibility and position

#### Audit Success

- There are some good examples of the success of auditing in effecting decisions

Should you require further information please contact either

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## APPENDIX A

Items that may be added to the current checklists

### Stage 2 Project Assessment

Checklist	Item	Issues to be Considered
1	2	- Is scour of channels likely will lining be required
	6	- What vehicles will use the access? What type of access standard is need Check the need to extend seal up access points
		- Do sight distances need checking for slow/heavy vehicles
	12	- Will differential settlement cause changes in geometry on curves
	13	- Are major changes in superelevation or friction demand likely to occur
2	1	- Will sight lines be obstructed in cuttings
	2	- Check control sight distances
		- Do special provisions need to be made to accommodate slow heavy traffic
6		Insert item 6 Physical Objects (poles, barriers etc) In particular the need for guardrails should be identified as early as possible
New Item		Matters not Considered (Supplied)



**Stage 3 Final Design**

Checklist	Item	Issues to be Considered
1	2	<ul style="list-style-type: none"><li>- If sumps become blocked will the overflow encroach on the carriageway.</li><li>- Location of manhole and sumps prove a hazard to pedestrians, cyclists, other vehicles</li></ul>
	4	<ul style="list-style-type: none"><li>- Check existing vegetation that will remain on site</li></ul>
	6	<ul style="list-style-type: none"><li>- Are sight lines from an access sufficient, especially if used by heavy machinery and or trucks</li><li>- Are the access slopes appropriate</li><li>- Will accesses require additional sealing to prevent migration of loose metal</li></ul>
	12	<ul style="list-style-type: none"><li>- Is a debris catch area required to stop material from falling onto the carriageway</li></ul>
	13	<ul style="list-style-type: none"><li>- Check that no dramatic changes in friction demand occurs along the alignment</li></ul>
	19	<ul style="list-style-type: none"><li>- Is sight benching required</li><li>- Are no passing lines required</li></ul>
	20	<ul style="list-style-type: none"><li>- What will happen to "old" road markings</li></ul>
2	2	<ul style="list-style-type: none"><li>- How do markings transition at interface</li></ul>
New Item		Matters not Considered (Supplied)

### Stage 4 Pre Opening (Post Construction)

Checklist	Item	Issues to be Considered
01	2	- Check for channel scour and at inlet and outlet structures - Check likelihood of blocking and assess overflow path
	4	- Landscaping will not produce an ongoing maintenance commitment to ensure safety
	6	- Are accesses sealed back sufficiently to stop loose material migrating onto the pavement
	17	- Check feather edges are correctly formed - Shoulder slopes are correctly formed - Trafficable shoulders are adequately compacted and free of excess loose material
	20	- Have old road markings been adequately removed
	21	- Are there changes in surface texture in areas of demand
03	1	- Check control type sight distance
	3	- Is advanced warning required and provided - Is loose material present in the intersection or covering markings - Is material migrating from adjacent unsealed roads - Are control signs in the drivers normal vision space
	3	- Item (3) add sumps, manholes - Do feather edges and other features narrow the usable shoulders
	New	- Stock movements, are there signs of stock movement Does this require signage
05	1	- Are the poles frangible where required Have the slip bases been correctly positioned

- 06            2        that hazard markers have been placed on all hazards within the trafficable shoulder
- 3        are the rails constructed in accordance with standard plans
- all splice bolts in place,
  - the 'laps' in the correct direction,
  - BCTs fitted
  - the necessary clear spaces provided behind the terminal if this area may be struck
- New Item            Matters not Considered (Supplied)

APPENDIX B  
DRAFT  
AUDIT SUMMARY DATA PAGE

Project Name:

Audit Stage :

Client:

Audit Team:

Members    i

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Observers    i

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Date of site visits:

Were night visits undertaken?:

Have previous audits been undertaken?:

Date of Audit Report: